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Masegosa, Andres; Martinez, Ana Maria; Ramos-López, Darío ; Langseth, Helge; Nielsen, Thomas Dyhre; Salmerón, Antonio; Cabanas, Rafael; Madsen, Anders Læsø

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A Java Toolbox for Analysis of Massive Data Streams using Probabilistic Graphical Models



Andrés R. Masegosa¹, Ana M. Martínez², Darío Ramos-Lopez³, Helge Langseth¹,
Thomas D. Nielsen², Antonio Salmerón³, Rafael Cabañas² & Anders L. Madsen^{2,4}

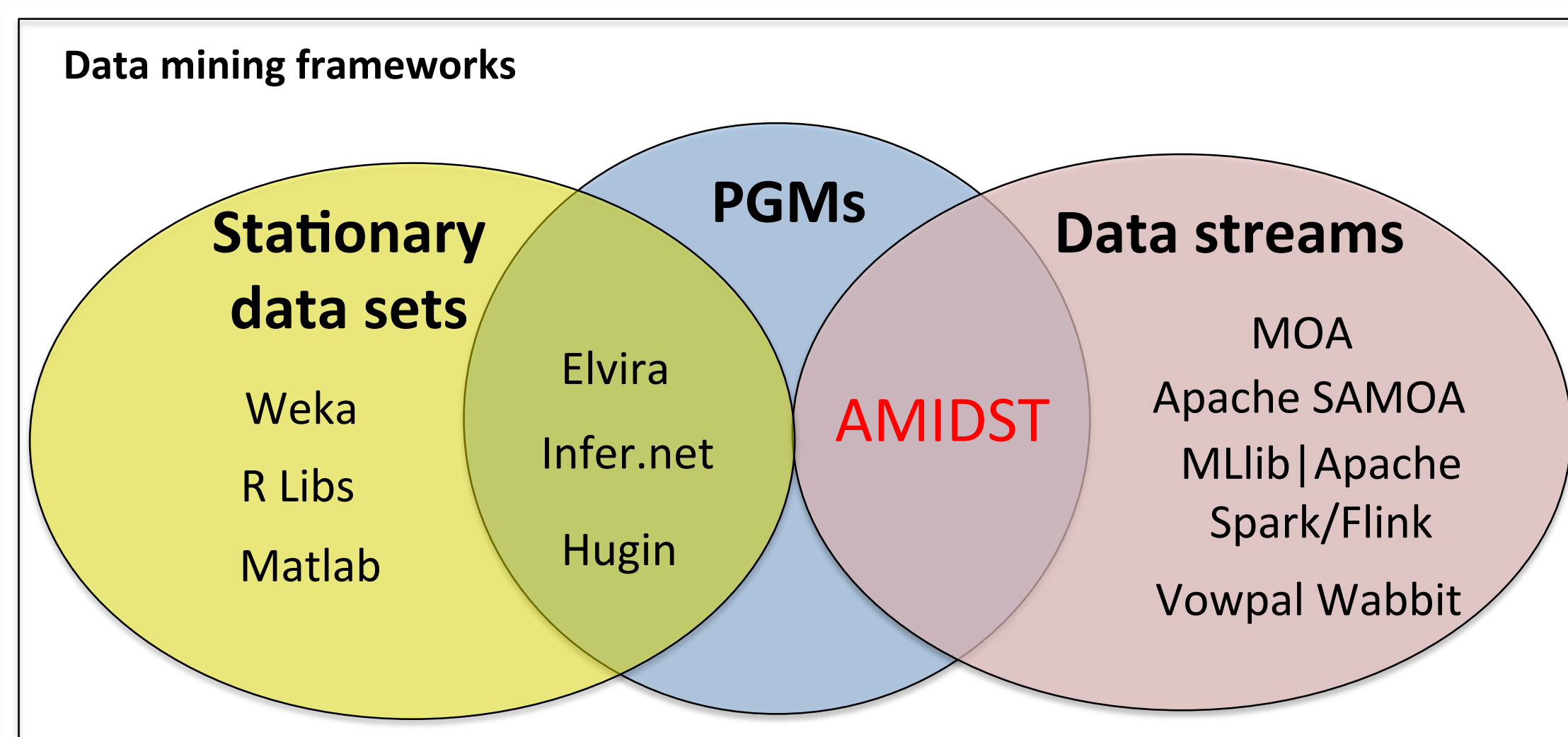
¹ Department of Computer and Information Science, NTNU, Norway

² Department of Computer Science, Aalborg University, Denmark

³ Department of Mathematics, University of Almería, Spain

⁴ Hugin Expert A/S, Aalborg, Denmark

Presentation



Academic and Industrial partners



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Description

- **Analysis of big data streams**: A complete collection of algorithms for inference and learning of both static and dynamic Bayesian networks from streaming data. Existing software systems for PGMs only focus on stationary datasets.
- **Distributed parallel algorithms**: AMIDST provides parallel multi-core and distributed implementations of Bayesian parameter learning, using streaming variational Bayes and variational message passing.

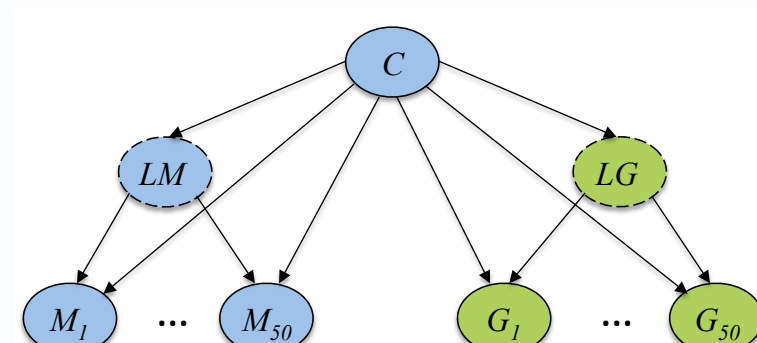
	STATIC	DYNAMIC
Maximum Likelihood	<ul style="list-style-type: none"> • Naïve Bayes • TAN • (G)AODE/HODE 	<ul style="list-style-type: none"> • Dynamic NB
Bayesian learning	<ul style="list-style-type: none"> • Gaussian Discriminant Analysis • Latent Classification Models (LCM) • Gaussian Mixtures • Bayesian Linear Regression • Factor Analysis • Mixture of FA 	<ul style="list-style-type: none"> • Dynamic LCM • Hidden Markov Model (HMM) • Kalman Filter (KF) • Switching KF • Factorial HMM • Auto-regressive HMM • Input-Output HMM

Main Features

Java 8 based



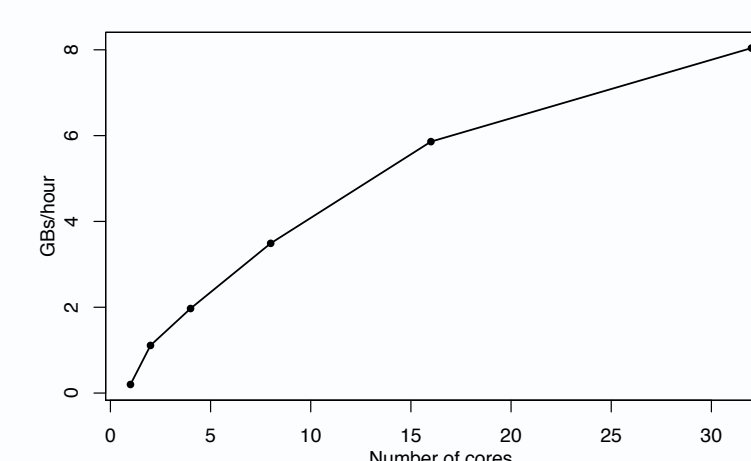
Latent variable models



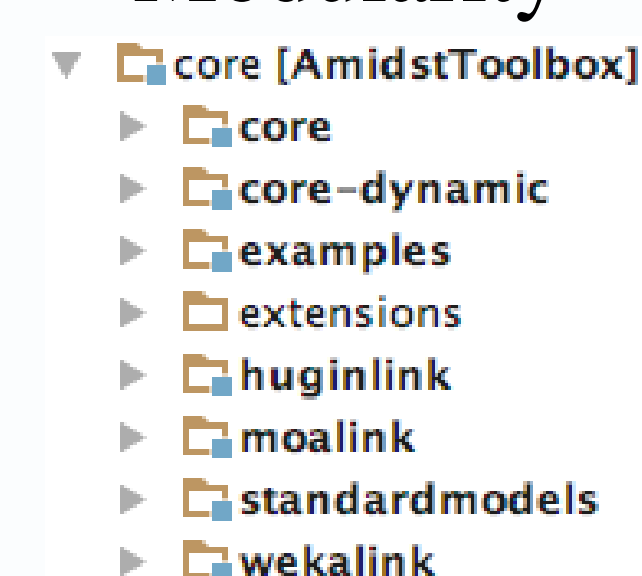
Integration



Big Data



Modularity



Open source



Code example

```

Learn hidden naive Bayes model from data stream

//We can open the data stream using the static class DataStreamLoader
DataStream<DataInstance> data = DataStreamLoader.openFromFile("datasets/simulated/
WasteIncineratorSample.arff");

//We create a SVB object
SVB parameterLearningAlgorithm = new SVB();

//We fix the DAG structure
parameterLearningAlgorithm.setDAG(DAGGenerator.getHiddenNaiveBayesStructure(data.
getAttributes(),"GlobalHidden", 2));

//We fix the size of the window
parameterLearningAlgorithm.setWindowSize(100);

//We can activate the output
parameterLearningAlgorithm.setOutput(true);

//We set the data which is going to be used for learning the parameters
parameterLearningAlgorithm.setDataStream(data);

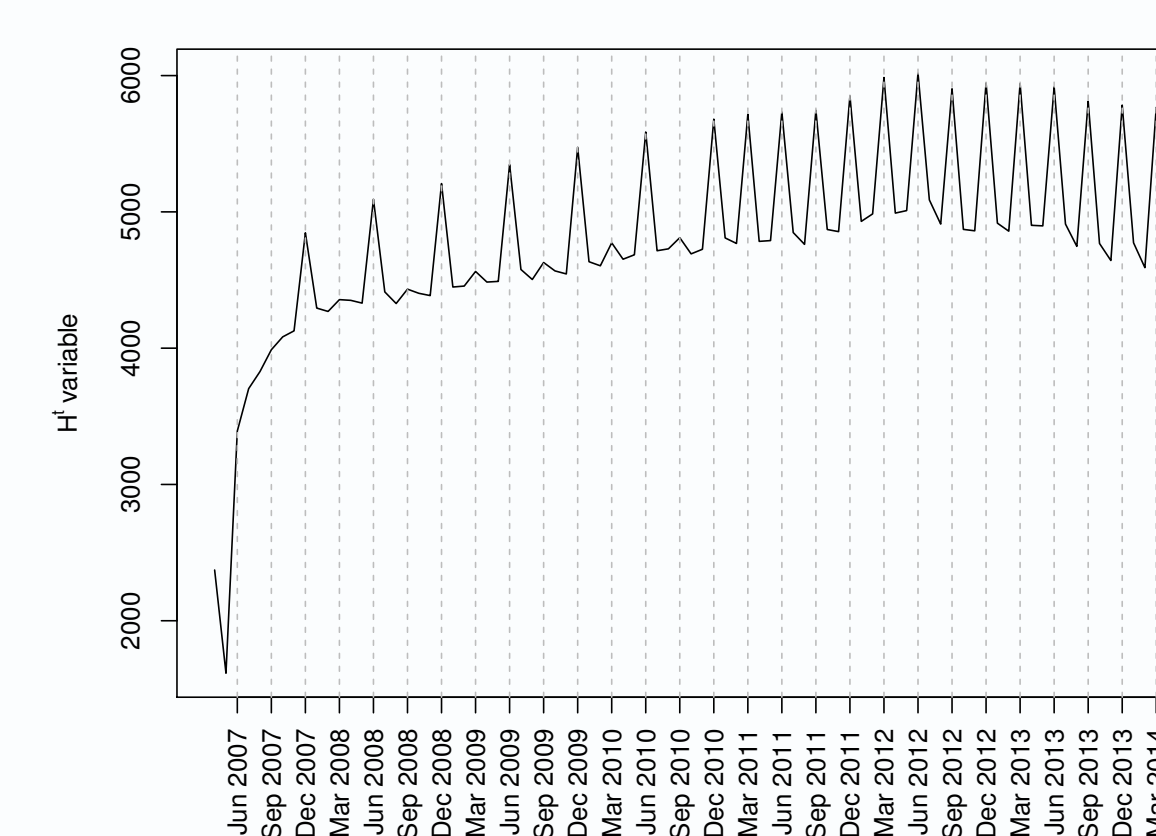
//We perform the learning
parameterLearningAlgorithm.runLearning();

//And we get the model
BayesianNetwork bnModel = parameterLearningAlgorithm.getLearntBayesianNetwork();

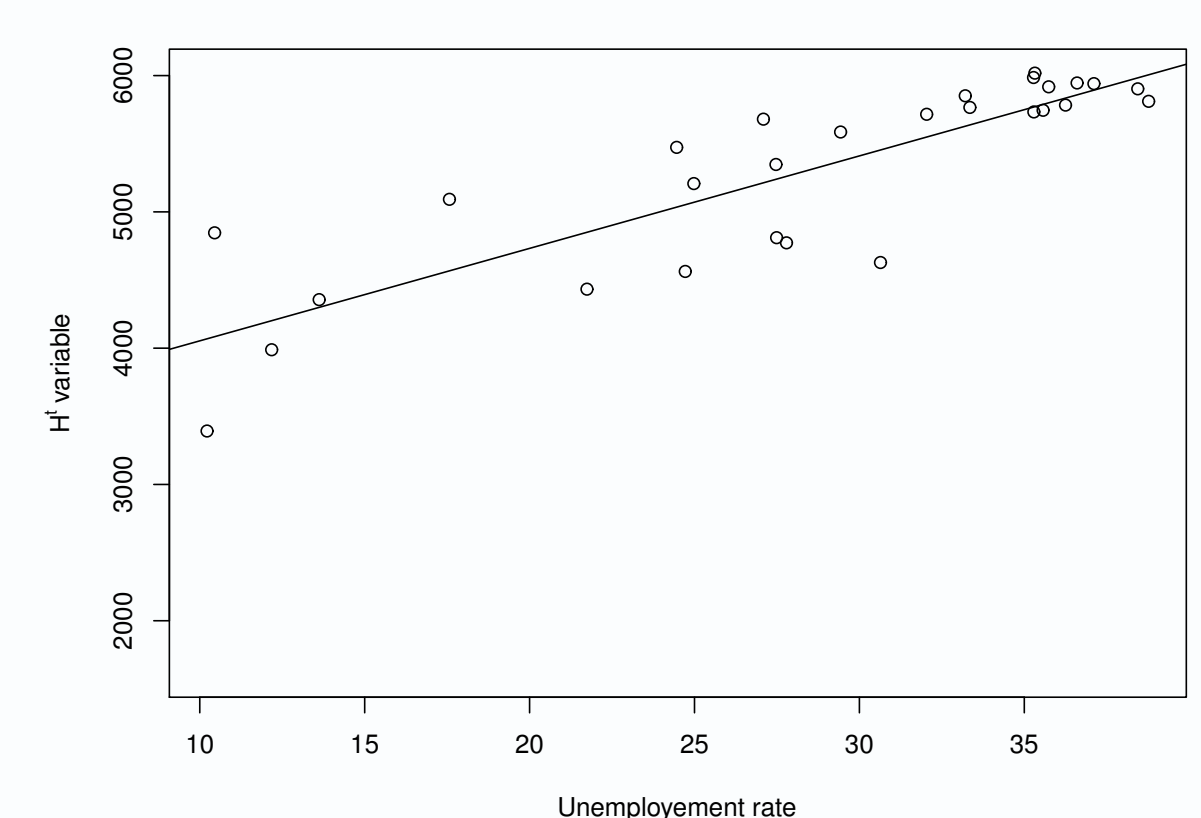
//We print the model
System.out.println(bnModel.toString());
    
```

Use-case: Risk prediction in credit operations

Concept drift



Correlated with Unemployment Rate



And much more...

amidst.eu
[amidst.github.io/toolbox/](https://github.com/AMIDST/toolbox/)



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